http://dx.doi.org/10.22161/ijeab/2.3.15 ISSN: 2456-1878

Indirect selection for resistance to *Alectra vogelii* (benth) infestation in cowpea (*Vignaunguiculata* (L) walp)

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Abstract— *Alectra vogelii (benth) is a parasitic weed which causes significant yield reductions in cowpeas (VignaunguiculataWalp) in most of the sub-Saharan African countries. The objective of this study was to establish the effect of Alectra vogelii infestation on yield components of cowpea and the prospects of utilizing these components for indirect select to A. vogelii in resistance breeding. Seven genotypes of cowpea were crossed in all possible combinations without reciprocals and their 21 F_2 progeny including parents were evaluated for reaction to Alectra vogelii infection at two locations, Ilonga and Hombolo. The experiments were laid using a Randomized Complete Block Design with three replications. Significant ($P < 0.001$) genotypic responses to Alectra emergency and infestation were found. A significance negative correlation was found between the Alectra emergency and infestation to yield and yield components ($P< 0.01$ and $P< 0.001$). However, both yield components (Number of pods per plant and 100 seed weight) tested exhibited a weak r^2 value (< 0.25) implying that these components can only be used to supplement and not as a substitute to direct selection in breeding for resistance to A. vogelii.*

Keywords— Alectra vogelii, correlation coefficient, resistance, selection, Vignaunguiculata.

I. INTRODUCTION

Cowpea is a most important pulse (legume crop) grown mostly in tropical and subtropical regions in Africa. It is well adapted to various climatic conditions ranging from humid to arid climates and often regarded as drought tolerant legume crop due to its high ability to be grown and giving yield in the areas with little and limited rainfall. Cowpea is grown mainly for human food, animal feeds and fodder, soil fertility improvement, while little of it gets into market as cash crop for income generation to smallholder farmers (Mbwaga*et al*, 2010; Stanley, 2012). Cowpea is a good source of cheap and high quality protein to many smallholder farmers' households' diet that's merely depends much on cereals crops for their daily diets. Therefore, cowpea in Africa serves as an ideal crop in alleviating the problem of food insecurity, reducing poverty, improving families' nutrition and health condition, and sustaining soil fertility for crop production when grown in intercropping, sole cropping or in rotation with cereals or with other crops (CGIAR, 2012).

Cowpea crop suffers a serious damage from the infestation by a parasitic weed of *Alectra vogelii* in various part of the sub- Saharan African (Singh and Emechebe, 1997; Mbwaga*et al*., 2010; Kabambe*et al*., 2013). Hand weeding, crop rotation, tapping crop and chemical control has been utilized ascontrol strategies to alleviate the damage caused by this parasitic weed in cowpea production thoughsuccess is very limited (Bouker*et al*., 2004; Rubiales *et al*., 2006). Growing of host plant resistance material against of *A. vogelii* infestation has been found to be more effective, environmentally friendly and economically feasible to small scale famers in sub- Saharan Africa (Rubiales *et al*., 2006). In that effect, genetic studies have been on-going and some materials have been released as a potential source of resistance to *A. vogelii* (Mbwaga*et al*., 2010; Karanja*et al*., 2013; Zitta*etal*., 2014). It has been reported that resistant genotypes improve yields by improving an effect on one or combination of the yield components such as: minimizing or preventing reduction of number of pods per plant, reduction in pods weight, reduction in number of seeds per pods, reduction in seed weight and reduction in chlorophyll contents of the leaves among other parameters (Geleta, 2010; Omoigui*et al*., 2011; Kutama*et al*., 2013; Karanja*et*

http://dx.doi.org/10.22161/ijeab/2.3.15 ISSN: 2456-1878

al, 2013). Therefore, identifying and quantifying the yield components in cowpea which are affected by *A. vogelii* infestation could help the breeder understand which component to prioritize when breeding for resistance to *A. vogelii* or could be used as indirect selection criterion in breeding for resistance or tolerance to this parasitic weed of *Alectra* in cowpea. This is important as screening for *A. vogelii* infestation is dependent on environmental factors (Mainjeni, 1993; Mbwaga*et al*., 2010). Therefore, the objective of this study was to establish the effect of *Alectravogelii* infestation on yield components of cowpea and the prospects of utilizing these components for indirect select to *A. vogelii* in a breeding program.

II. MATERIALS AND METHODS

Experimental layout as well as germplasm used is the same as implemented or utilized by Mbwando*et al*., 2016 but different evaluation aspects were considered. Field evaluationwere conducted in Ilonga (06° S, 37° E, Altitude, 506 M) and Hombolo (5° 52' S, 35° E, Altitude1100m) agricultural research stations. Seven cowpea genotypes (Table 1) with varying reaction to *Alectra vogelii* infestation were assembled from IITA and Ilonga Agriculture Research Institute (ARI- Ilonga). The genotypes were crossed in all possible combinations but without reciprocals to produce 21 F_1 progeny which were advanced into F_2 population in the screen house in 2014/2015 cropping season. Rachie*et al*., 1975 crossing procedures were used for conducting artificial/controlled pollination.

Seven parental genotypes and their 21 F_2 crosses were evaluated for their reaction to *A. vogelii* in the field in 2015/2016 cropping season using a randomized complete block design with 3 replications from February to April. Fields assigned for evaluation were naturally infested by *Alectra* weed, however artificial inoculation was done to increase the pressure of infestation.Infestation of the soil was done by planting *Alectra* seeds with cowpea seeds at planting time by puttinga full spoon of *Alectra* seeds per hill that calibrated to deliver about 1000 seeds of.

Table.1: Descriptions of materialsused in an experiments to determine the reaction of cowpea genotypes to Alectra vogelii infestation in 2014/ 2015 cropping season at Ilonga and Hombolo Agriculture stations in Tanzania

Parental identity	Genotype	Reaction to *A. vogelii*	Source
P_1	B301	Resistant	IITA
P_2	IT99K-7-21-2-2-1	Resistant	ARI-Ilonga
P_3	IT99K-573-1	Resistant	ARI-Ilonga
P_4	IT99K-1122	Tolerant	ARI-Ilonga
P_5	VULI-1	Susceptible	ARI-Ilonga
P_6	VULI-2	Susceptible	ARI-Ilonga
P_7	TUMAINI	Susceptible	ARI-Ilonga

IITA, International Institute for Tropical Agriculture; ARI, Agricultural Research Institute

*Alectra*per hill. Single row plot of 5.0 m length and the spacing between and within row of 0.75 and 0.3 m respectively were used on sowing cowpea seeds. Trials within two locations were kept free of weeds by hoe weeding for the first five weeks and then by hand weeding from six weeks after planting. No fertilizers were applied to both trials to reduce the interference of *A. vogelii* emergency and infestation.

At 10 weeks after planting data on number of cowpea plants infested by *Alectra* per plot and number of *Alectra* shoots emerged per plot were recorded (Geleta, 2010). Number of pods per plot, total grain yield per plot and 100 seed weight were also recordedat crop maturity, 12 weeks after planting. Inspection of the plot of residues (Data not shown) on number of emerged *Alectra* shoots per plot or number of cowpea plants infested, revealed violation of the ANOVA pre-requirements. Hence data had to be transformed by using square root method, $\sqrt{(X+1)}$, where "X" was the number of cowpea plants infested by *Alectra* or number of emerged *Alectra* shoots per plot to normalized the situation.

Genotypic responses among all measured parameters were analyzed using analysis of variances (ANOVA) in GenStat Discovery 15^{th} (Payne *et al*., 2012). Relationships between parameters measured were equally performed by using correlations (r)in GenStat Discovery 15^{th}. Amount of Phenotypic evaluation explained (r^2) was computed as a square of the correlation (r).

III. RESULTS AND DISCUSSION

High significant differences ($P < 0.001$) were found in all measured parameters among genotypes used in this study at Ilonga site (Table 2) while no significant difference were observed in *Alectra* emergency and infestation at Hombolo site (Table 3). The observed significance differences among genotypes across the location in their reaction to *A. vogelii*(Table 4) indicate that the parameters are influencedby environmental changes (Mbwaga*et al*., 2010).

The mean genotypic responses (Table 5) on measured parameters showed that, Genotype IT99K-573-1xIT99K-7-21-2-2-1, IT99K-7-21-2-2-1 and IT99K-573-1 were free from *Alectra* emergency and infestation. VULI-1, IT99K-1122xVULI-1 and VULI-1xVULI-2 supported largest number of *Alectra* shoots and number of cowpea plant infested by *Alectra* than all genotypes.This result reveals the variations in genotypic responses to some measured traits in this study. Therefore, there is a possibility of utilizing these traits in as an indirect selection criterion in breeding for resistance to *Arectra vogelii* in cowpea. Total grain yield and number of pods formed per plot exhibited a negative correlation to *Alectra* shoots emerged and infestation.

Table.2: Analysis of variance mean squares for cowpea genotypes materials used in an experiment to evaluate their reaction to Alectra vogeliiinfestation at Ilonga site in 2014/2015 cropping season

Source of variation	d.f	No. *Alectra* Shoots	No. Plant infested	Grain Yield	No. Pods formed	100 seed weight
Replication	2	2.13	0.56	74575517002.654		
Genotypes	27	3.20***	0.75***	77110***	52640***	13.84***
Error	54	0.38	0.09	2341118654		2.971

*and *** significantly different at 0.5 and 0.001 probability levels respectively

Table.3: Analysis of variance mean squares for cowpea genotypes materials used in an experiment to evaluate their reaction to Alectra vogeliiinfestation at Hombolo site in 2014/2015 cropping season

Source	d.f	No. *Alectra* Shoots	No. Plant infested	No. Pods formed	Grain Yield	100 seed weight
Replication	2	0.66 0.0511747149930.8517				
Genotypes	27	1.12	0.16	27800***	25799***	2.90***
Error	54	1.290.1564465282		0.5942		

***, significantly different at 0.001 probability levels

Genotypes where no *Alectra* shoots emerged, recorded highest number of pods per plot and total grain yield and the reverse was true (Table 5). Karanja*et al*., (2013) and Zitta*et al*., (2014) reported the same trend to the response of cowpea genotypes growing under *Alectra* infestation. This suggests that *Alectra* infestation probably tends to reduce the yield of cowpea genotypes by allowing the accumulation of dry matter in the cowpea roots at the expenses of the pods so as to feed the parasitic weed of *Alectra* (Karanja*et al*., 2013).

Table.4: Analysis of variance mean squares for cowpea genotypes materials used in experiments to evaluate their resistance to Alectra vogeliiinfestation across sites in 20014/2015 cropping season

Source	d.f	No. *Alectra* Shoots	No. Plant infested	No. Pods formed	Grain Yield	100 seed weight
Replication	2	2.51 0.3824154309472.51				
Genotypes	27	2.56**	0.54***	59608***	79411***	13.91***
Location	1	3.593.57***743071***		1364520***	264.86***	
G x Location	27	1.770.37*20832*23498*2.836*				
Error	54	1.200.1513036 15152		1.763		

*,**,*** significantly different at 0.5, 0.01 and 0.001 probability levels respectively

http://dx.doi.org/10.22161/ijeab/2.3.15 ISSN: 2456-1878

Mugabe (1983) and Zitta*et al*., (2014) reported that *Alectra* infestation causes the reduction in the photosynthetic capability of the plant which results to lower number of pods per plant formed with subsequent reduction in pod weight and total grain yield. This could be due to the reduction in chlorophyll contents of the leaves of the infested cowpea plants due to high competitive nature of the attached parasitic weed on absorbing nutrients crucial for chlorophyll synthesis (Kutama*et al*., 2013). Likewise, Press (1995) reported that, lower biomass synthesis as a result of competition between the host and parasites forassimilates and solutes, including carbon and water which lowers rate of photosynthesis under *Alectra* infestation.

Considering these revelations (Press, 2014; Karanja*et al*., 2013; Zitta*et al*., 2014) that yield components are directly affected by *A. Vogelii* infestation, there is a need to quantify these correlation responses in order to validate their utilization for indirect selection in breeding for resistance or tolerant to *A. vogelii*. A significance negative correlation was found between *Alectra* emergency and infestation to yield component and total yield at Ilonga site (Table 6) while no significant correlation were observed at Hombolo site (Table 7).

Table.5: Response of cowpea genotypes on Alectra shoot emerged, number of cowpea plant infested by Alectra, number of pods formed, 100 seed weight and total grain yield at Ilonga site in 2015 cropping season

Genotype/ Crosses	No of *Alectra* Shoot/ plot	No of Cowpea Plant Infested/ plot	No of Pods Formed	100 Seed Weight	Total Grain Yield/ plot
P_3xP_4	0.00	0.00	664.0	10.19	809.0
P_2	0.00	0.00	706.3	9.64	893.0
P_3	0.00	0.00	458.0	11.83	655.3
P_4	0.33	0.33	586.3	8.94	769.1
P_2xP_7	1.00	0.67	504.3	11.19	614.6
P_1	1.33	0.67	438.0	11.15	558.7
P_1xP_4	1.67	1.67	482.0	12.08	530.3
P_5xP_7	1.67	1.33	343.0	17.59	437.4
P_2xP_4	2.33	1.00	506.3	9.64	608.5
P_2xP_5	2.33	1.33	402.0	11.94	509.0
P_1xP_2	2.67	2.00	312.7	12.02	433.4
P_2xP_3	2.67	2.00	443.3	11.51	536.3
P_3xP_5	2.67	1.33	377.7	12.26	480.8
P_4xP_5	2.67	2.33	397.0	11.60	498.8
P_2xP_6	2.67	1.33	378.0	11.41	475.1
P_1xP_5	3.00	2.67	437.3	10.80	508.1
P_1xP_7	4.00	1.67	440.3	9.81	522.2
P_3xP_7	4.00	1.33	358.7	12.91	410.5
P_1xP_3	5.00	2.00	245.3	13.97	249.0
P_3xP_6	6.00	1.33	557.3	11.15	593.5
P_6	6.33	3.00	382.3	9.50	427.4
P_1xP_6	6.67	2.67	343.0	17.59	436.4
P_7	7.67	3.00	338.0	10.86	381.0
P_4xP_7	8.00	3.00	97.9	14.0	158.5
P_6xP_7	13.67	5.00	103.0	15.1	93.1
P_5	14.33	4.67	304.7	13.04	301.2
P_4xP_6	19.67	6.33	271.0	12.59	292.6
P_5xP_6	29.00	8.67	190.0	13.54	276.6
L.S.D	11.15	3.14	223.6	2.82	250.5

LSD- Least Significant difference performed at 5% level of probability

The fact that no significant correlations for yield components to '*A vogelii* infestation' and 'number of *Alectra* emerged' were obtained at Hombolo, implies that the significant correlations observed in Ilonga are directly linked to the effect of *A. vogelii* on cowpea genotypes. Thus unlike in Hombolo significant genotypic responses among traits measured to *Alectra* infestation were obtained at Ilonga. Failure to obtain significant differences in Hombolo on genotypic responses to *A. vogelii* could be due to environmental factors of which drought is a suspect. This is supported by Mbwaga*et al.*, 2010 who deduced that drought reduces the virulent effect of *A. vogelii*. Indeed in this season Hombolo received 437.82 mm amount of rainfall compared to Ilonga which received 1002.64 mm. Total grain yield had highly significant ($P < 0.001$) negative correlation coefficients with both number of *Alectra* shoots emerged and number of cowpea plant infested ($r = -0.39$ and $r = -0.46$ respectively). Likewise number of pods per plot also had a highly significant ($P < 0.001$) negative correlation coefficient with both number of *Alectra* shoots emerged and number of cowpea plant infested ($r = -0.37$ and $r = -0.44$ respectively). On the other hand, hundred seed weight also was found to have a significant ($P < 0.01$) negative correlation coefficient with both number of *Alectra* shoots emerged and number of cowpea plant infested ($r= -0.26$ and $r = -0.33$ respectively). These results suggested that, there were a decrease in number of pods per plant formed, seed weight (100 seeds weight) and total grain yields in the cowpea plant with increasing in number of *A. vogelii* shoots emerged. This signifies that, there is high competition for assimilates and solutes between cowpea plant and *Alectra* andprobably most of the assimilates synthesized by the crop are deposited in the roots of cowpea at the expenses of the pods so as to feeds the parasitic weeds of *Alectra vogelii* which leads to the reduction of the total grain yields of the crop (Press, 1995; Karanja*et al*., 2013). The significance negative correlation between seed weight to number of *Alectra* shoots emerged and number of cowpea plants infested by *Alectra* suggested that, *Alectra* reduces the quality of seed by affecting seed size (Mbwaga*et al*., 2007 and 2010; Karanja*et al*., 2013).

Total grain yield had recorded a positive significant ($P < 0.001$ and $P < 0.05$) correlation with number of pods per plot ($r = 0.94$), while negative significant ($P < 0.01$) correlation was observed with correlation 100 seed weight ($r = -0.29$) (Table 6). The positive and significance correlation between total grain yield and number of pods per plot suggested that yield improvement would be possibly be achieved by selecting for the number of pods per plant.However, number of pods is also negatively correlated with *Alectra* infestation and this signifying that yield improvement under *Alectra vogelii* infestation would be enhanced by indirectly selecting for plants with higher number of pods per plant.However the low r^2(r^2= 0.07), (which is a measure of the amount of phenotypic variation explained) imply that number of pods cannot be used as a solely selection criterion but can be used to supplement direct selection methods.

Table.6: Correlation coefficient among yield, yield components, number of Alectra shoots emerged and number of cowpea plants infested by Alectra for cowpea genotypes materials used in an experiment to evaluate their reaction to Alectra vogeliiinfestation at Ilonga site in 2014/2015 cropping season

	No of Cowpea Plant infested by *Alectra*	No of *Alectra* shoot emerged	100 seed weight	No of Pods formed	Total Grain Yield
No of Cowpea Plant infested					
No of *Alectra* shoot emerged	0.8773***				
100 Seed Weight	-0.3256**	-0.2545**			
No of Pods formed	-0.4415***	-0.3705***	-0.3314**		
Total Grain Yield	-0.4595***	-0.3920***	-0.2947**	0.9442***	-----

,* significantly different at 0.01, and 0.001 probability levels respectively

http://dx.doi.org/10.22161/ijeab/2.3.15 ISSN: 2456-1878

Table.7: Correlation coefficient among yield, yield components, number of Alectra shoots emerged and number of cowpea plants infested by Alectra for cowpea genotypes materials used in an experiment to evaluate their reaction to Alectra vogeliiinfestation at Hombolo site in 2014/2015 cropping season

	No of cowpea plant infested by *Alectra*	No of *Alectra* shoot emerged	100 seed Weight	No of Pods formed	Total Grain Yield
No of Cowpea Plant infested					
No of *Alectra* shoot emerged	0.8320***				
100 Seed Weight	-0.0810	-0.1118			
No of Pods formed	-0.0613	-0.0028	-0.0918		
Total Grain Yield	-0.0834	-0.0302	-0.1823	0.9602***	--------

*** significantly different at 0.001 probability level

IV. CONCLUSION

Results showed that among the yield components tested, *A. vogelii* infestation (in Ilonga where significant genotypic responses were obtained) affected number of pods per plant ($r = -0.44$; $r^2 = 0.19$) much more than seed weight ($r = -0.33$; $r^2 = 0.11$). However both components showed lowr^2 values implying that these components especially number of pods per plant (since it's positively correlated to yield) can only be used to supplement and not as a substitute to direct selection in breeding for resistance to *A. vogelii* in cowpea.

V. ACKNOWLEDGEMENT

I am very grateful to Innovative Agricultural Research Initiative (iAGRI) project in Tanzania for supporting this research as part of Masters study at the University of Zambia through association with Regional Universities Forum for Capacity Building in Agriculture (RUFORUM). Also am grateful to McKnight Foundation Collaborative Crops Research Project in Tanzania to their financial support for the publication of this article.

REFERENCES

[1] Acquaah, G. 2007. Introduction to quantitative genetics In: Principles of plant genetics and breeding. Black well Publisher, Carlton Australia. pp 126-144.

[2] AOAC. 1984. Official methods of analysis. 14th, Association of Official Analytical Chemists. Washington, DC, USA: 522-533.

[3] Boukar, O., Kong, L., Singh, B. B., Murdock, L and Ohm, H. W. 2004. AFLP and AFLP-derived SCAR markers associated with *Strigagesnerioides*resistance in cowpea. *Journal of Crop Science*, 44: 1259-1264.

[4] Geleta, L. F. 2010. Cowpea landraces of Botswana: A potential resistance source for *Alectra vogelii*. *Aspect of Applied Biology*: pp 96.

[5] CGIAR. 2012. Leveraging legumes to combat poverty, hunger, malnutrition and environmental degradation. In: Research program on grain legumes. Unpublished revised proposal submitted by ICRISAT, CIAT, ICARDA and IITA to CGIAR 15 August, 2012: 7-12

[6] Kabambe, V., Katanga, L., Kapewa, T., Ngwira, A. R. 2008. Screening legumes for integrated management of witch weeds (*Alectra vogelii* and *Strigaasiatica*) in Malawi. *AfricanJournal of Agricultural Research*, 3: 708-715.

[7] Karanja, J. K., Nguluu, S. N., Wambua, J., Gatheru, M. 2013. Response of cowpea genotype to *Alectra vogelii* parasitism in Kenya. *African Journal of Biotechnology*, 12: 6591-6598.

[8] Karanja, J. K., Nguluu, S. N., Gatheru, M. 2010. Farm yard manure reduces the virulence of *Alectra vogelii* (Benth) on cowpea (*Vignaunguiculata)*. Unpublished paper presented at Bondo University College conference, February, 2010.

[9] Kutama A. S., Hayatu, M., Umar, S. 2013. Effect of *Alectra vogelii* (Benth) Infestation on the Growth of some Genotypes of Cowpea (*Vignaunguiculata* [L] Walp). *Standard Research Journal of Agricultural Science*, 2: 33- 39.

[10] Mbwaga, A., Hella, J., Mligo, J., Kabambe, V., Bokos, J. 2007. Development and promotion of *Alectra* resistant cowpea cultivars for smallholder farmers in Malawi and Tanzania. McKnight Foundation Collaborative Crops Research Project No: 06741.

[11] Mbwaga, A., Hella, J., Mligo, J., Kabambe, V., Bokos, J. 2010. Development and promotion of *Alectra* resistant cowpea cultivars for smallholder farmers in Malawi and Tanzania. McKnight Foundation Collaborative Crops Research ProjectNo: 06741.

[12] Mbwando A., Lungu, D. M., Tryphone, G. M., Tembo, L. 2016. Nature of resistance of cowpea

http://dx.doi.org/10.22161/ijeab/2.3.15 *ISSN: 2456-1878*

Alectra vogelii infestation. *African Crop Science Journal*. 24: 389-395.

[13] Omoigui, L. O., Kamara. A. Y., Ishiyaku, M. F., Bouker, O. 2012. Comparative response of cowpea breeding lines to*Striga* and *Alectra* in the dry savannah of northeast Nigeria. *African Journal of Agricultural Research*, 13:45-67.

[14] Press, M. C. 1995. How do the parasitic weeds *Striga*and *Orobancheae*influence host carbon relation? *Aspects of Applied Biology*, 42: 63-70.

[15] Payne, R. W., Murray, D. A., Harding, S. A., Baird, D. B., Soutar, D. M. 2012. An Introduction to GenStat for Windows (17th Edition). VSN International, Hemel Hempstead, UK

[16] Rubiales, D., Perez de Luque, A., Fernandez-Aparica, M., Sillero, J. C., Roman, B., Kharrat, M., Khalil, S., Joel, D. M., Riches, C. R (2006) Screening techniques and sources of resistance to parasitic weeds in grain legumes. *Euphytica*, 147: 187-199.

[17] Rugare, J. T., Mbwasa, S., Tsekenedza, S. 2013. Response of Cowpea (*Vignaunguiculata*L.) Genotypes to Witch weed *Alectra vogelii* (Benth) Infection. *Asian Journal of Agricultural and Rural Development*,3: 667-673.

[18] Simmonds, N. W. 1979. Principles of crop improvement, Longman Inc. New York, United states of America:95-97

[19] Singh, B. B., Emechebe, A. M. 1997. Advances in research on cowpea *Striga*and *Alectra*. In: Advances in cowpea research. Singh, B.B., Mohan, R., Dashiell, K.E and Jackai, L.E.N:215-224. IITA-Jirca, Ibadan, Nigeria.

[20] Zitta, C., Magani, E. I., Ahom, R. I. 2014. Screening of Cowpea Genotypes for their Reaction to *Alectra vogelii* (Benth) in the Southern Guinea Savanah of Nigeria. *Journal of Natural Science Research*: l 4- 15.